

Modeling Notebook Service Center

MGT239 Simulation for Business

Group Members

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Background

- ▶ To model the operation of a notebook repair Service Center
- ▶ The Service Center provides:
 - Basic Service (do not need parts)
 - Full Service (need parts)



Background

- ▶ **8** full-time engineers
 - Capacities are identical
- ▶ The warehouse is nearby
 - provide **95%** fill rate of the parts
- ▶ Within **1 hour (60 minutes)** service completion guarantee
- ▶ Fulfill the target service level of **90%**



Objective

▶ **Cost assumption:**

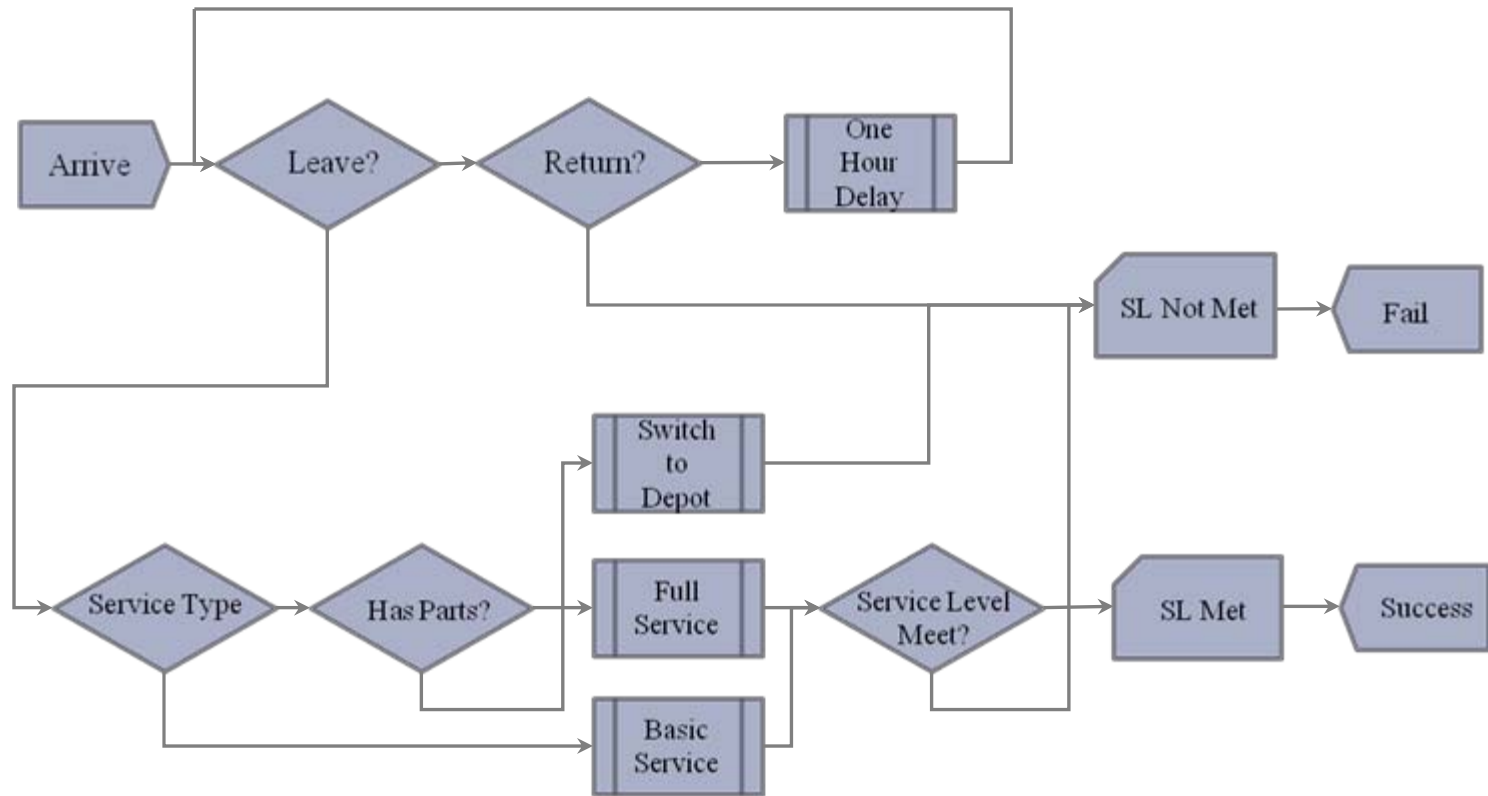
- Rent of the service center and utility cost are fixed
- The only variable cost is the salary (identical) of engineers

▶ **Purpose:**

To find the minimum number of engineers (minimum cost) and reach the service level satisfaction of 90%



Model: Notebook Service Center



Model: Notebook Service Center

ARRIVE

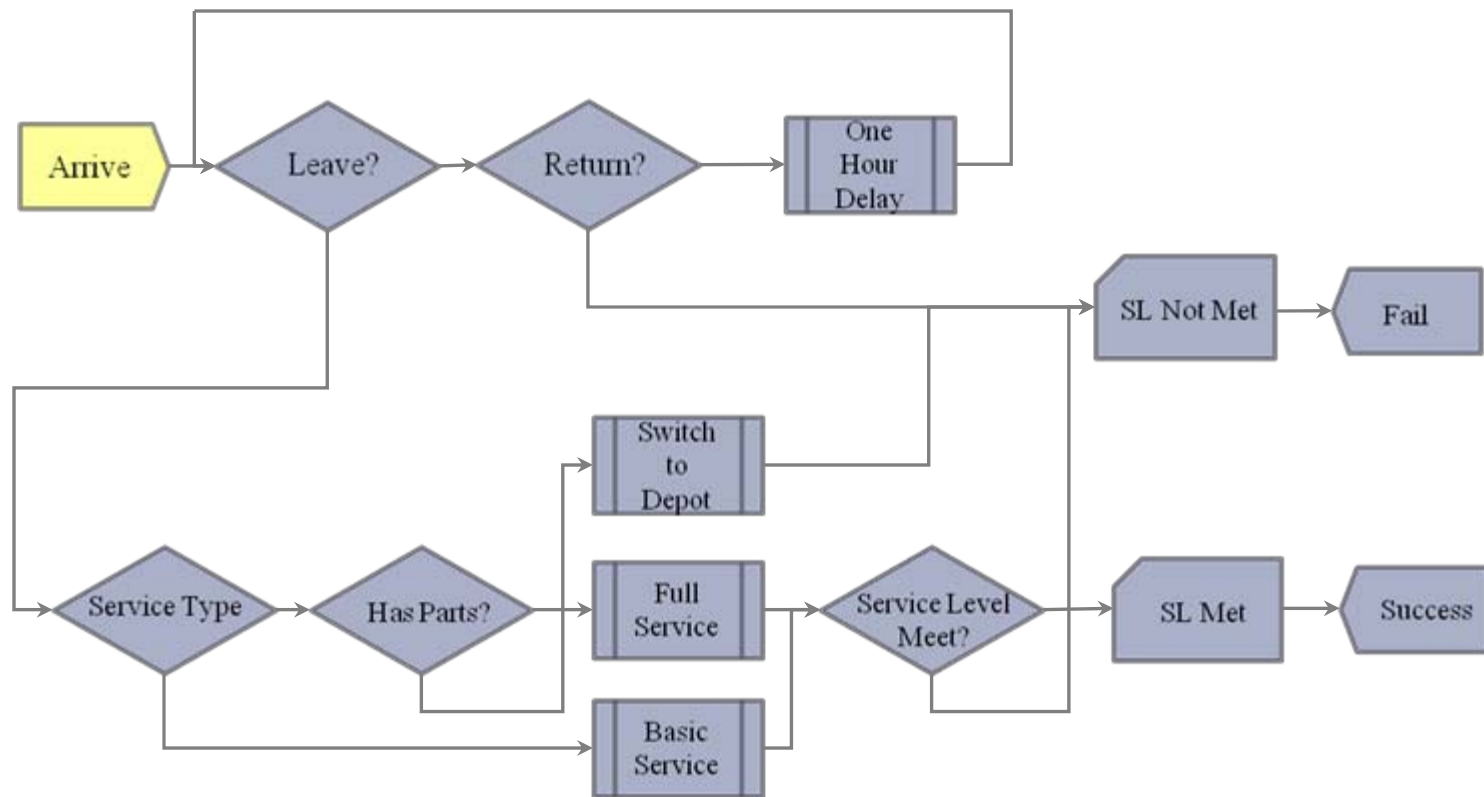
of Customers

Monday:	95
Tuesday:	85
Wednesday:	80
Thursday:	78
Friday:	70

Parameter:

Exponential (mins)

Monday:	5.05
Tuesday:	5.65
Wednesday:	6.00
Thursday:	6.15
Friday:	6.86



Model: Notebook Service Center

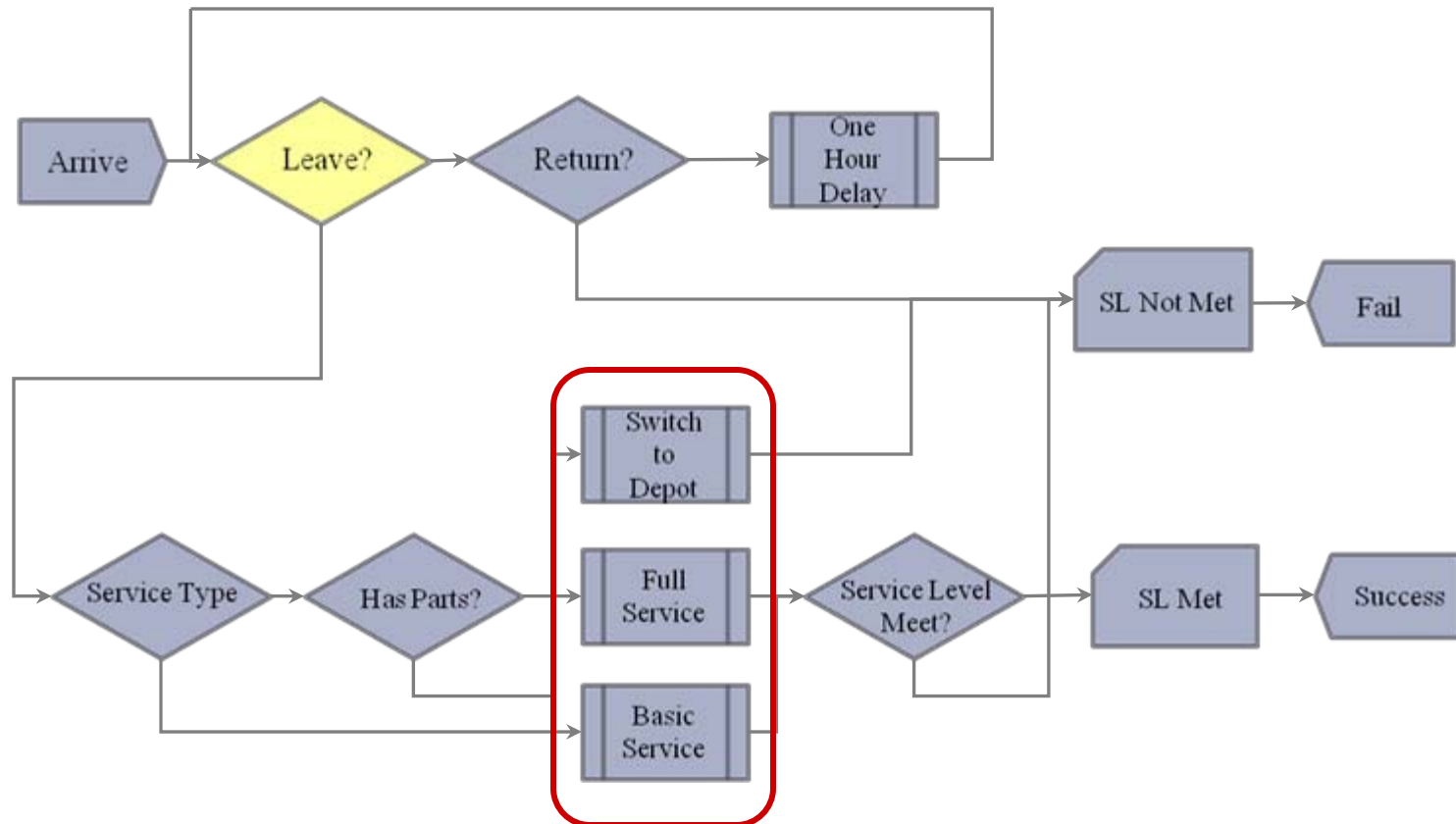
LEAVE

Situation:

The customer will leave when he/she finds total number of waiting in queues is more than **8**

Parameter:

$NQ(\text{Basic Service.Queue}) + NQ(\text{Full Service.Queue}) + NQ(\text{Switch to Depot.Queue}) > 8$

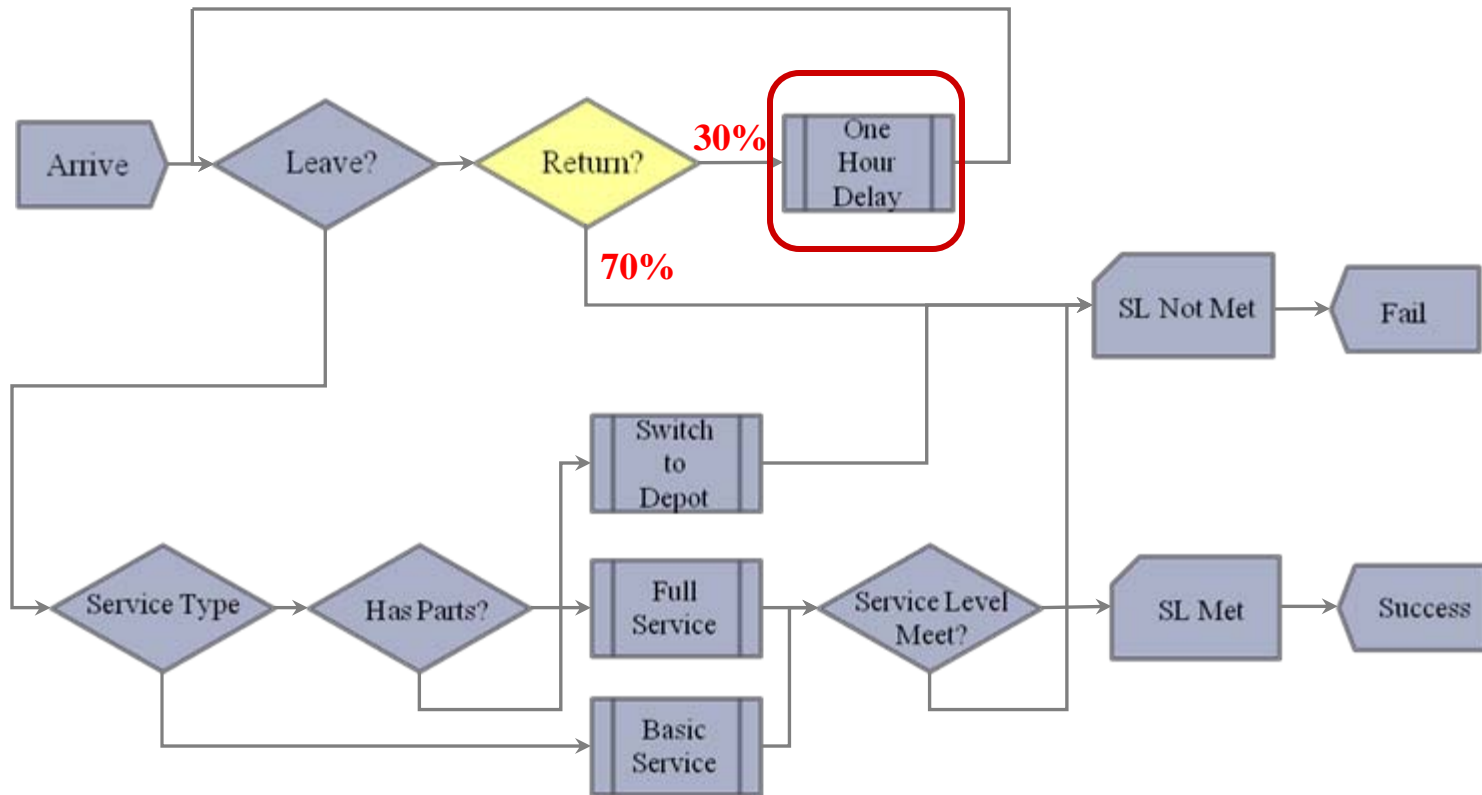


Model: Notebook Service Center

Return?

Situation
30% of the customers will return after one hour, 70% will balk

Parameter
Two-way by chance
True: 30%
False: 70%



Model: Notebook Service Center

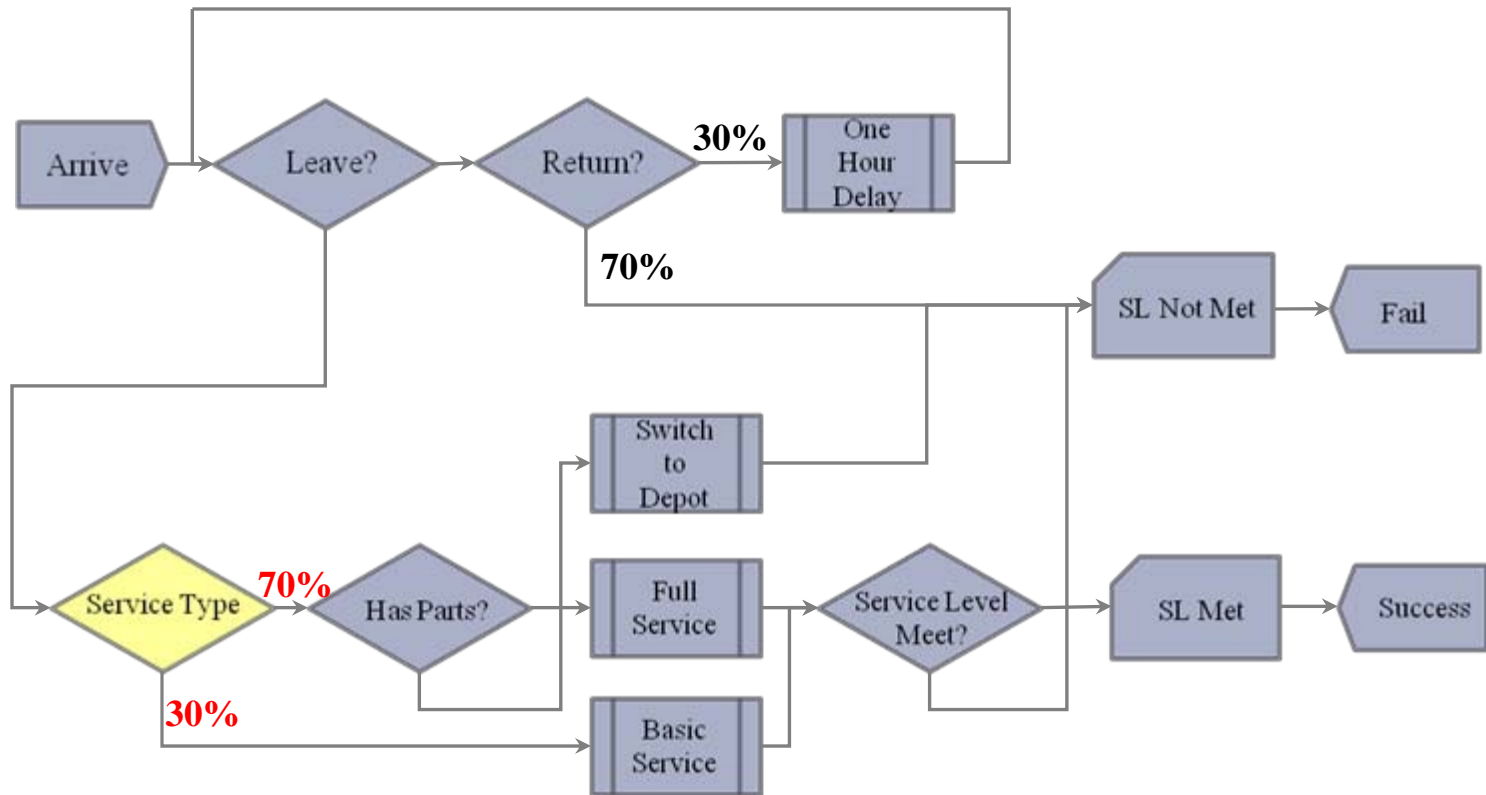
Service Type

Situation

Basic Service (30%):
consultation, no
parts required
Full Service (70%):
hardware problem,
parts required

Parameter

Two-way by chance
True: 70%
False: 30%

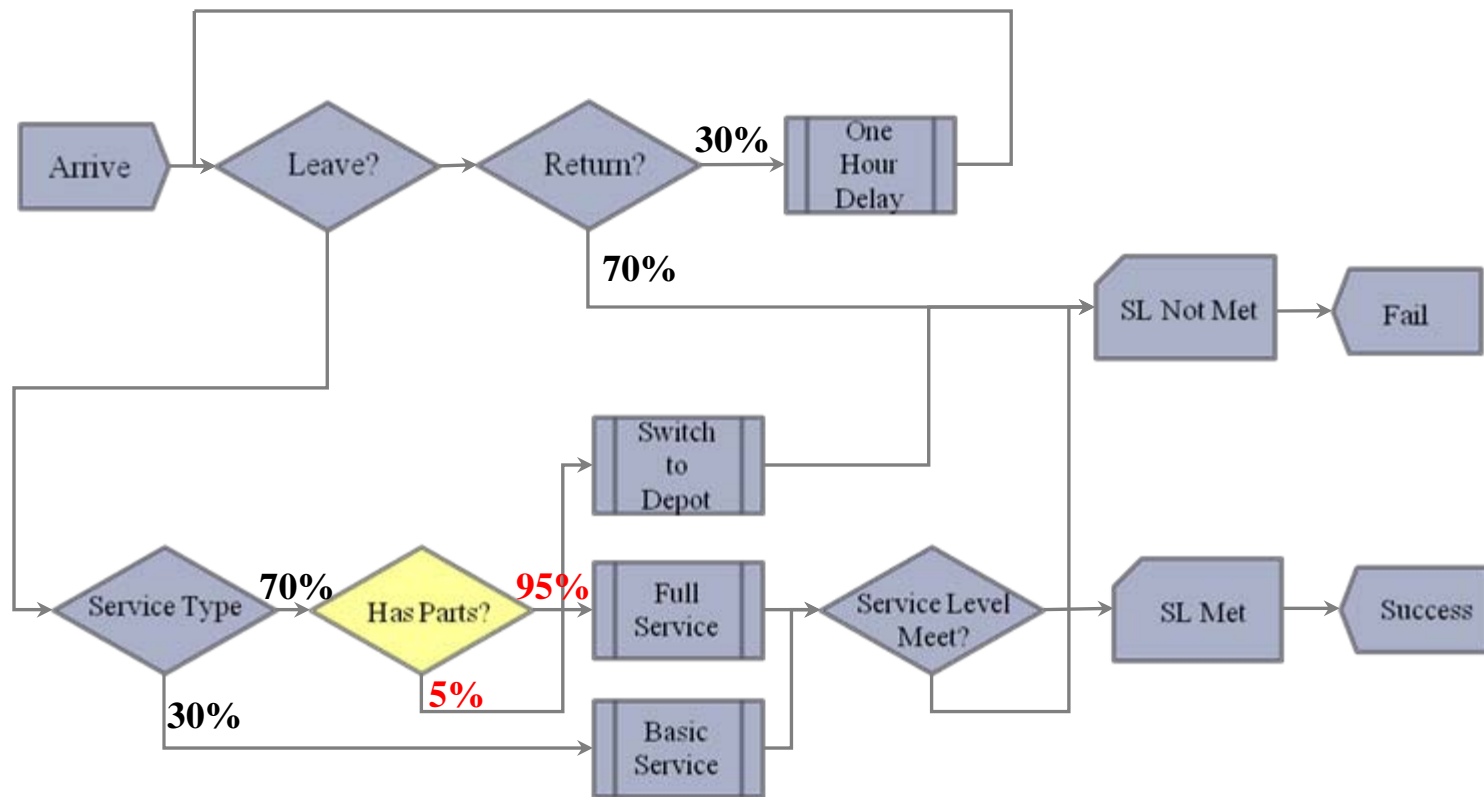


Model: Notebook Service Center

Has Parts?

Situation
Warehouse guarantees 95% of parts required will be available immediately

Parameter
Two-way by chance
True: 95%
False: 5%



Model: Notebook Service Center

Switch to Depot

Situation

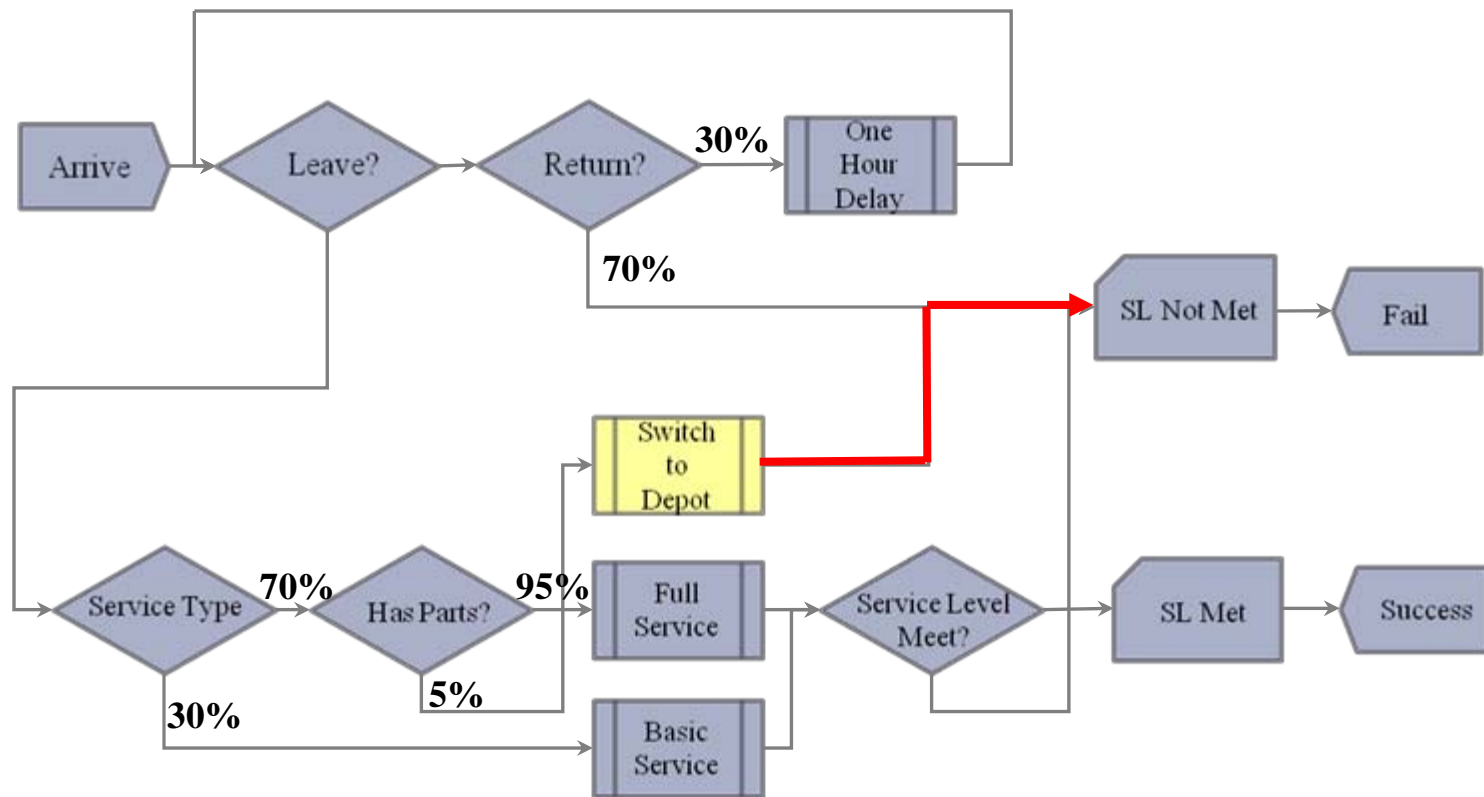
If parts are not available, customer will be informed to pick-up three days later.

It requires engineer to diagnose and process for 20 mins with std of 5 mins

Parameter

$NORM(20, 5)$

Set: Engineers



Model: Notebook Service Center

Full Service

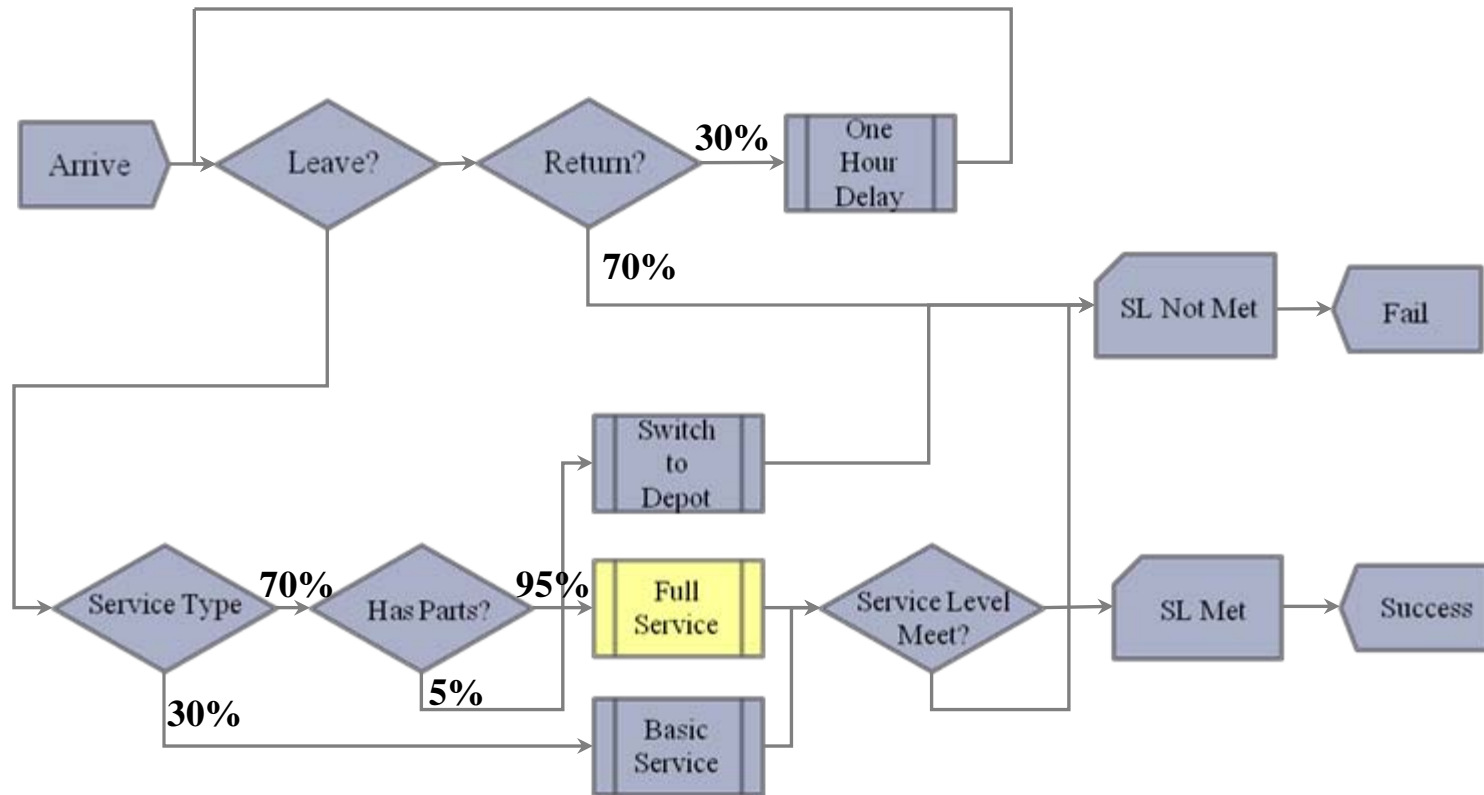
Situation

It takes an average of 45 mins with std of 8 mins to complete

Parameter

$NORM(45, 8)$

Set: Engineers



Model: Notebook Service Center

Basic Service

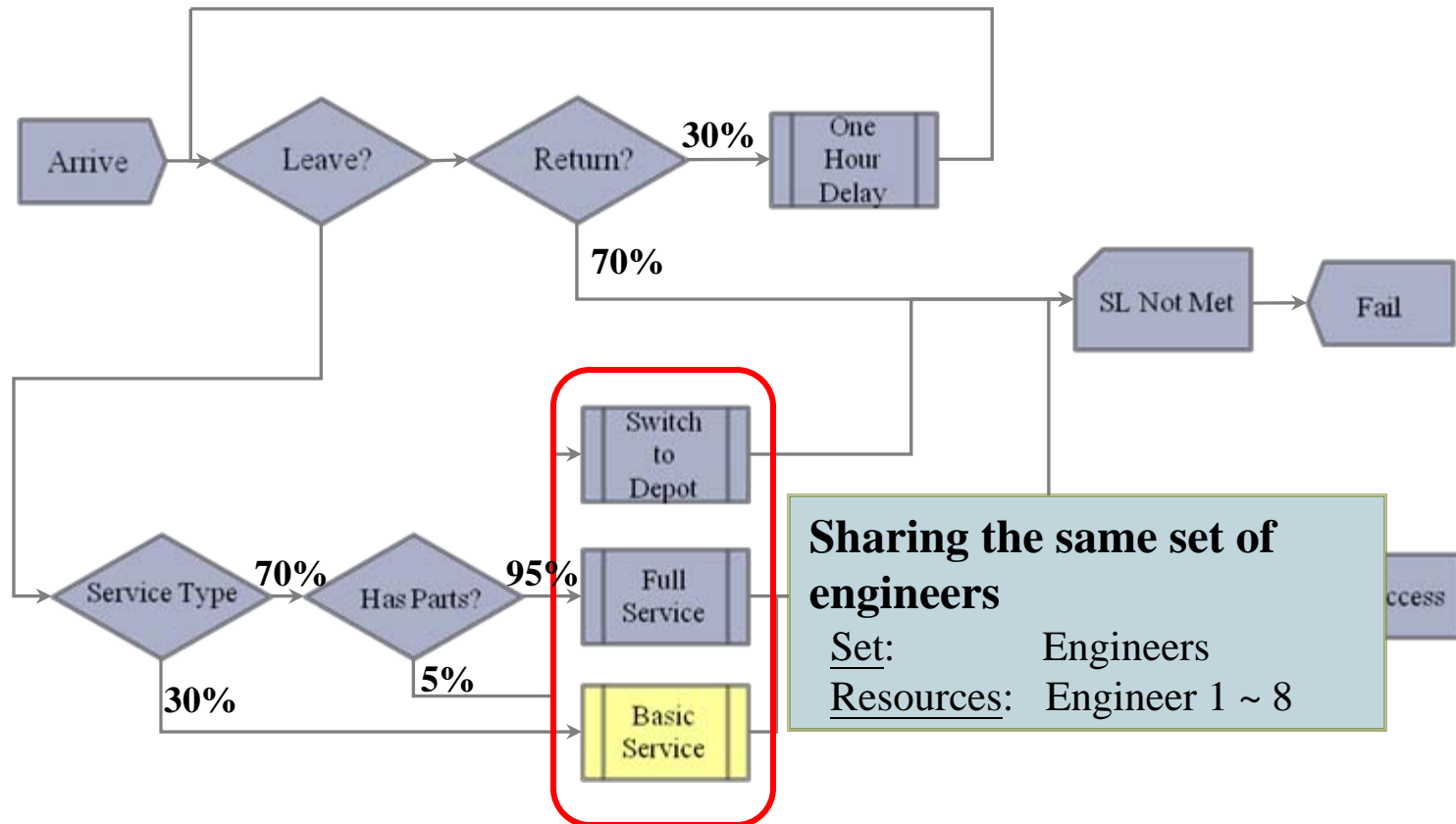
Situation

It takes an average of 10 mins with std of 2 mins to complete

Parameter

$NORM(10, 2)$

Set: Engineers



Model: Notebook Service Center

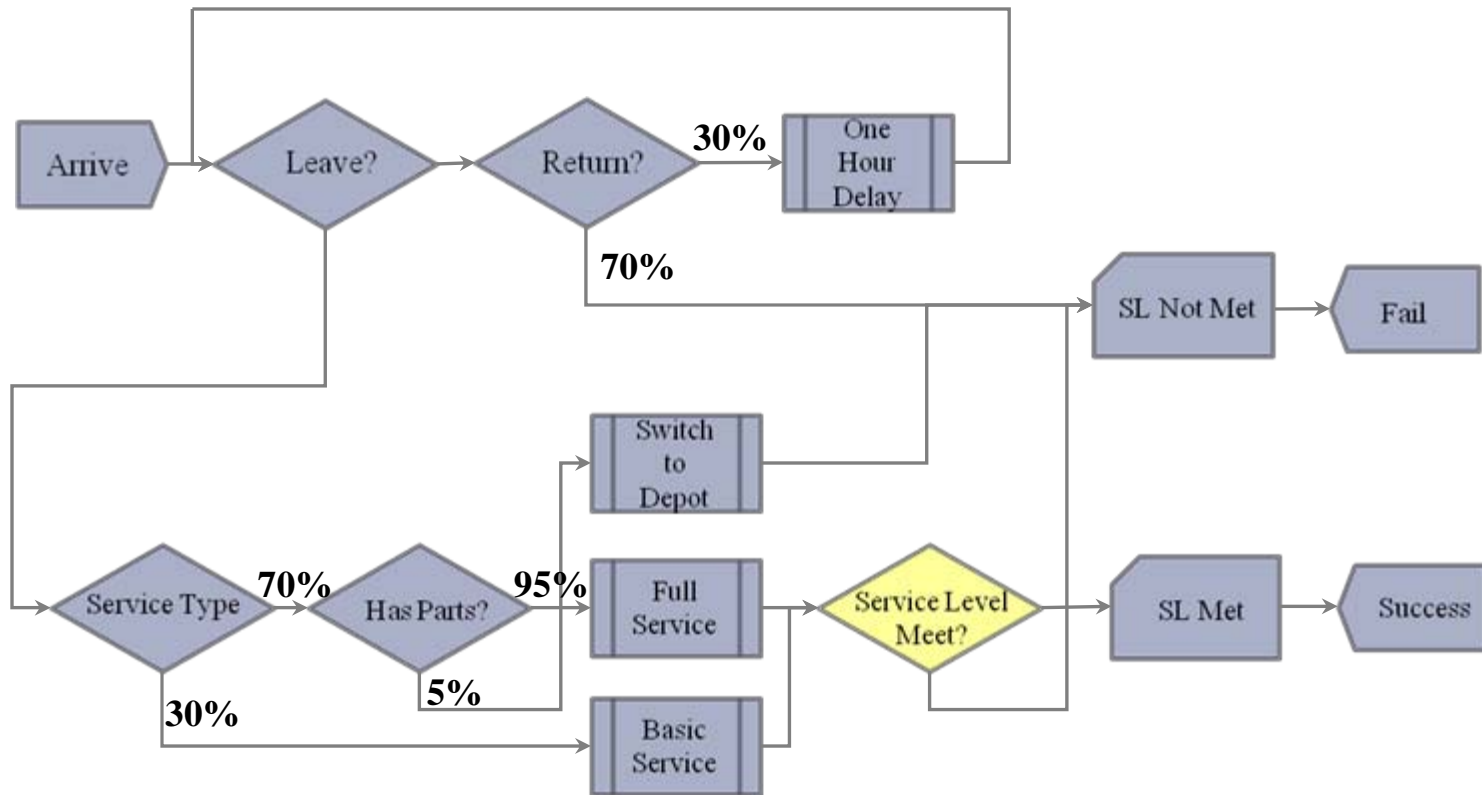
Service Level Met?

Situation

The service term is to complete service within 60 minutes
 Cases will be counted as failure if total service time exceeds 60 minutes

Parameter

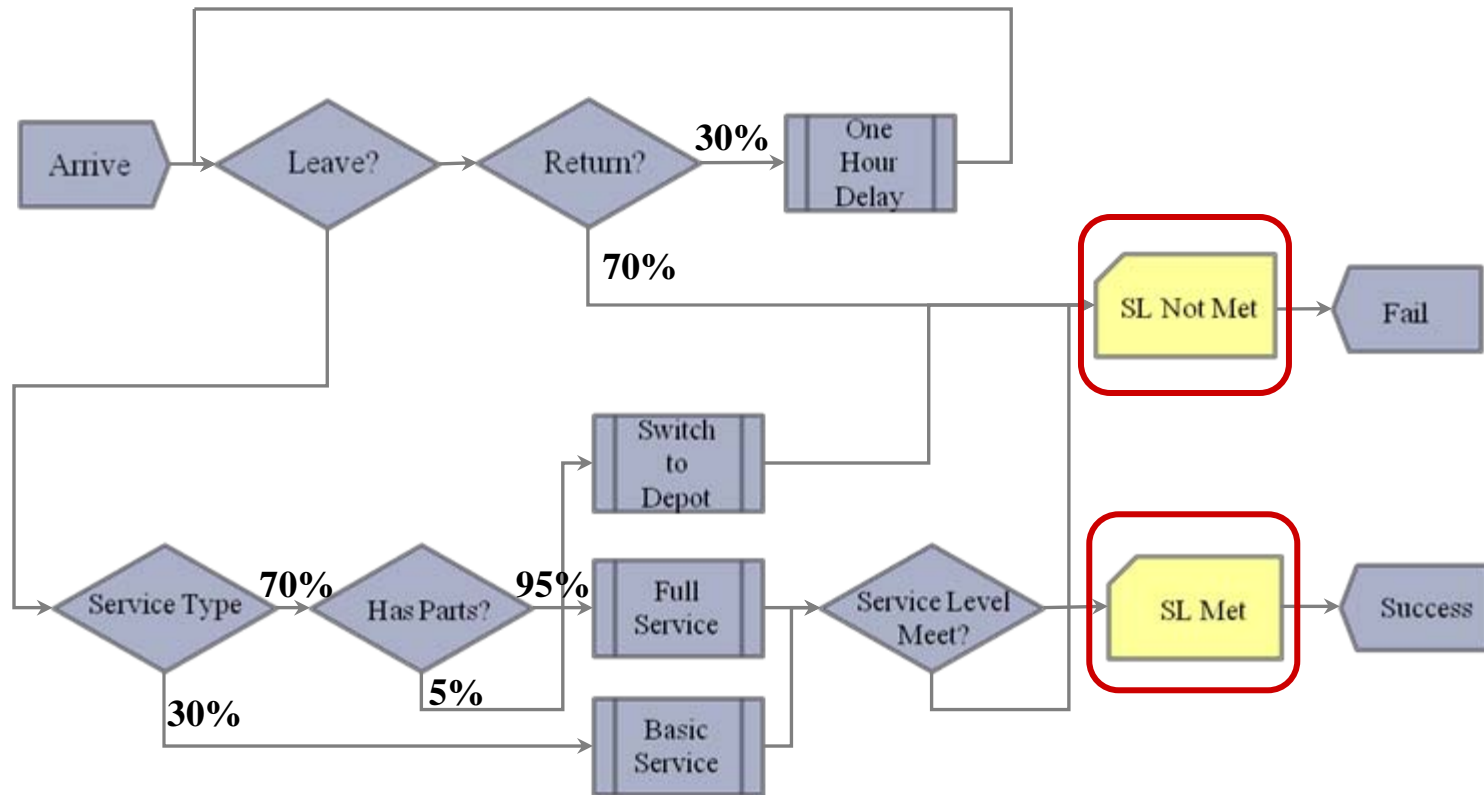
$(Entity.VATime) + (Entity.NVATime) + (Entity.OtherTime) + (Entity.TranTime) < 60$



Model: Notebook Service Center

Meet? Not Meet?

Situation
Record the cases that meet and fail the service agreement



Results (Statistics)

- ▶ After running the simulation on the weekdays (from Monday to Friday), we calculate the average service level of the five days under different number of engineers to find the optimal minimum number of engineers.

- ▶ Service Level Calculation:

$$\text{Service Met} / \text{Total Cases} = \text{Service Level (\%)}$$

8 engineers

8 engineers					
	Total case	# of Service meet	# of Service not meet	Service level (%)	Ave. Utilization
Mon	89	83.4	5.2	93.71%	0.7966
Tues	81	76.4	4.1	94.32%	0.7451
Wed	78	73.7	3.9	94.49%	0.7069
Thurs	75	71.7	3.6	95.60%	0.6808
Friday	66	62.8	3.6	95.15%	0.5937
Average	77.8	73.6	4.08	94.60%	0.7046

7 engineers

7 engineers					
	Total case	# of Service meet	# of Service not meet	Service level (%)	Ave. Utilization
Mon	89	81.6	7.4	91.69%	0.8756
Tues	84	78	6	92.86%	0.8564
Wed	75	71.3	3.5	95.07%	0.7695
Thurs	73	69.2	3.9	94.79%	0.7500
Friday	68	65	3.2	95.59%	0.6989
Average	77.8	73.02	4.8	93.86%	0.7901

6 engineers

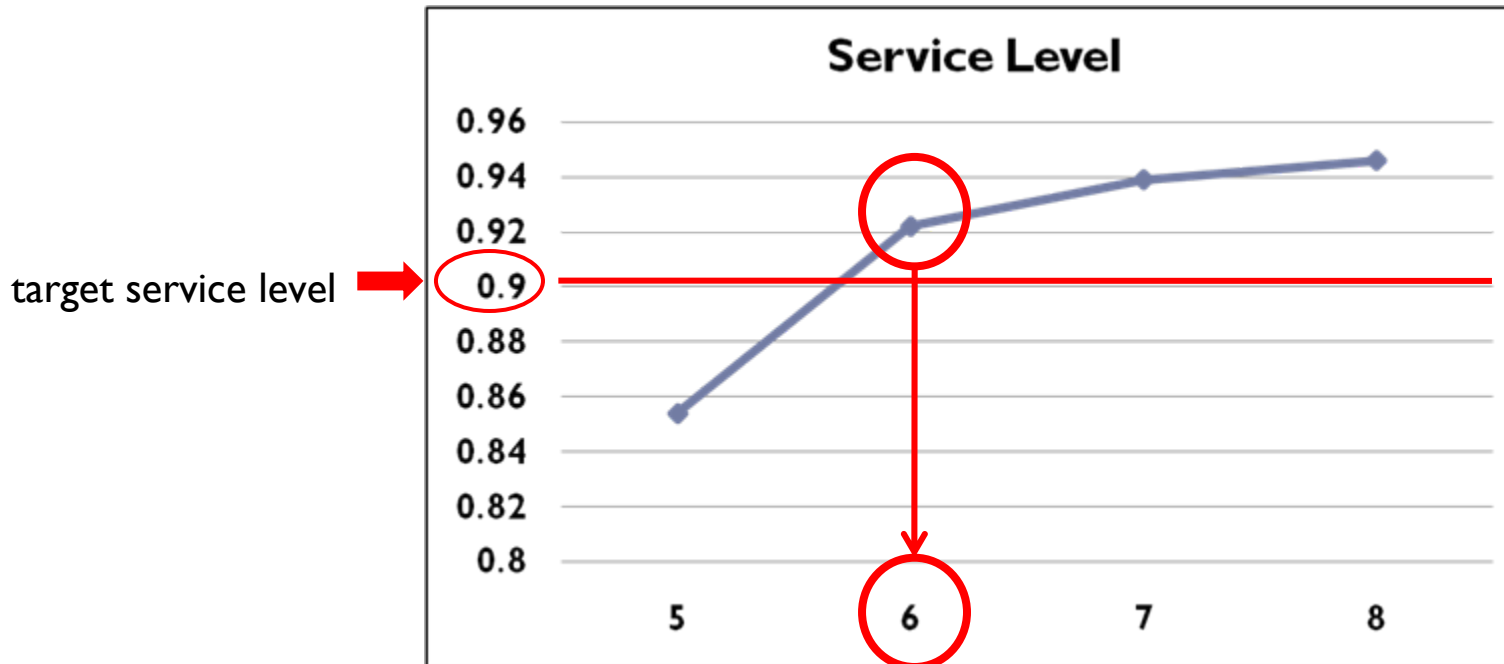
6 engineers					
	Total case	# of Service meet	# of Service not meet	Service level (%)	Ave. Utilization
Mon	87	75.3	12	86.55%	0.9213
Tues	77	71.85	5.15	93.31%	0.8581
Wed	74	68.8	4.85	92.97%	0.8298
Thurs	72	67.55	4.05	93.82%	0.8060
Friday	68	64.15	3.555	94.34%	0.7670
Average	75.6	69.53	5.921	92.20%	0.8364

5 engineers

5 engineers					
	Total case	# of Service meet	# of Service not meet	Service level (%)	Ave. Utilization
Mon	82	60.4	22	73.66%	0.9648
Tues	70	62.6	8	89.43%	0.9436
Wed	70	60	9.5	85.71%	0.9171
Thurs	67	60.9	6.5	90.90%	0.9233
Friday	63	56.8	6	90.16%	0.8887
Average	70.4	60.14	10.4	85.43%	0.9275

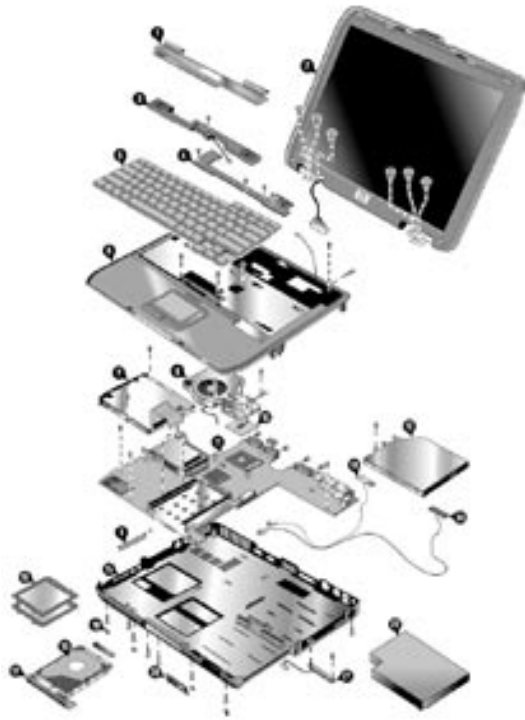
Conclusions

# of Engineer	# of Cases	Ave. # of Service Met	Ave. # of Service Not Met	Service Level	Ave. Utilization of engineers
5	70.4	60.1	10.4	0.854	0.9275
6	75.6	69.5	5.9	0.922	0.8364
7	77.8	73	4.8	0.939	0.7901
8	77.8	73.6	4.1	0.946	0.7046



Recommendation

- ▶ According to the result, our recommendation for the service center is to reduce the workforce from eight to six.



Q&A

Thank You!